



# THE EFFECTS OF ACUTE DIETARY NITRATE SUPPLEMENTATION ON MAXIMAL EXERCISE PERFORMANCE

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## Abstract

**INTRODUCTION:** Beet juice has recently become a growing dietary supplement used by athletes to improve exercise performance. Beet juice is high in dietary nitrates which is absorbed in the upper gastrointestinal tract. The nitrate is then converted into nitrite which is further reduced to nitric oxide. Nitric oxide regulates muscle blood flow via vasodilation and mitochondrial respiration. Research shows that dietary nitrate supplementation reduces the oxygen cost of submaximal exercise for the same workload. This results in more mechanical efficiency of muscle contraction.

**PURPOSE:** The purpose of this experiment was to determine if dietary nitrate improves aerobic exercise performance.

**METHODS:** Three female and two male (age 21 ± 1 yr) students from UTA, volunteered to participate in this study. Each subject had height and weight taken and body mass index (BMI) was calculated. The subjects were randomly assigned to either the placebo (PL) or beetroot juice (BR) group. Each subject performed a graded exercise test on the treadmill with increasing speed and elevation until exhaustion. On a separate day the subjects then returned to the lab and completed the test using the other drink. During each test heart rate (HRmax) and rate of perceived exertion (RPE) were recorded along with relative maximal oxygen consumption (VO<sub>2</sub>max) and time until exhaustion (T).

**RESULTS:** The BMI for the subjects was 22.68±3.88. The maximal values: VO<sub>2</sub>max (PL: 37.86 ± 5.84 ml/kg/min; BR: 37.9 ± 2.97 ml/kg/min); RPE (PL: 18 ± 0.71; BR: 18.6 ± 0.89); and T (PL: 10:41 ± .045 min; BR: 10:15 ± 0.023 L/min) were not significantly different between the groups (p > 0.05). However, there was a statistically significant difference (p = 0.035) between the groups for maximal heart rate (PL: 196.8 ± 10.08 bpm; BR: 193.6 ± 11.19 bpm).

**CONCLUSION:** The results of this study indicate that acute beetroot juice supplementation does not have any effect on VO<sub>2</sub>max, RPE or T. However, HRmax is decreased during maximal exercise which can be attributed to increased mechanical efficiency of the cardiac muscle following supplementation.

## Purpose

- ❑ The evidence suggests that dietary nitrate in the form of beet juice can be used to improve aerobic performance during maximal aerobic exercise. The purpose of this experiment is to determine if dietary nitrate improves aerobic exercise performance.

## Methods

- ❑ Five recreationally active individuals (three females and two males) volunteered to participate in the study.
- ❑ The subjects were required to come to the lab twice during the study. On the first day the subjects had their height, weight and BMI measured as presented in Table 1.
- ❑ The subjects were randomly assigned to either the placebo (black cherry juice) or beet juice group.
- ❑ The subjects then completed a graded exercise test utilizing the Bruce protocol on the treadmill until exhaustion.
- ❑ On a separate day the subjects then returned to the lab and completed the test using the other drink.
- ❑ During each test heart rate (HRmax) and rate of perceived exertion (RPE) were recorded along with relative maximal oxygen consumption (VO<sub>2</sub>max) and time until exhaustion (T).
- ❑ A Polar heart rate monitor was used to measure heart rate and the Parvo metabolic cart was used to measure VO<sub>2</sub>max.

## Methods (cont'd)

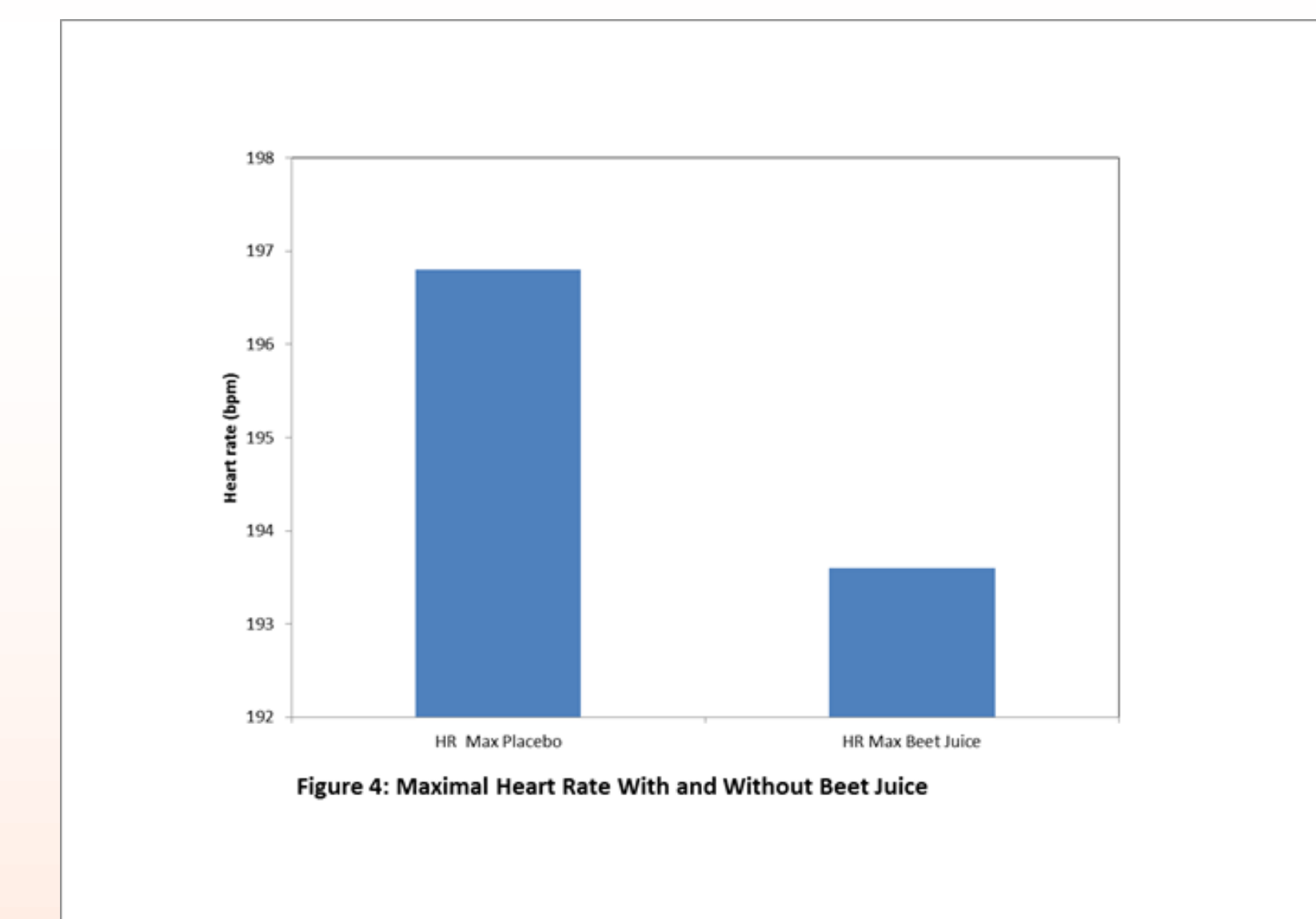
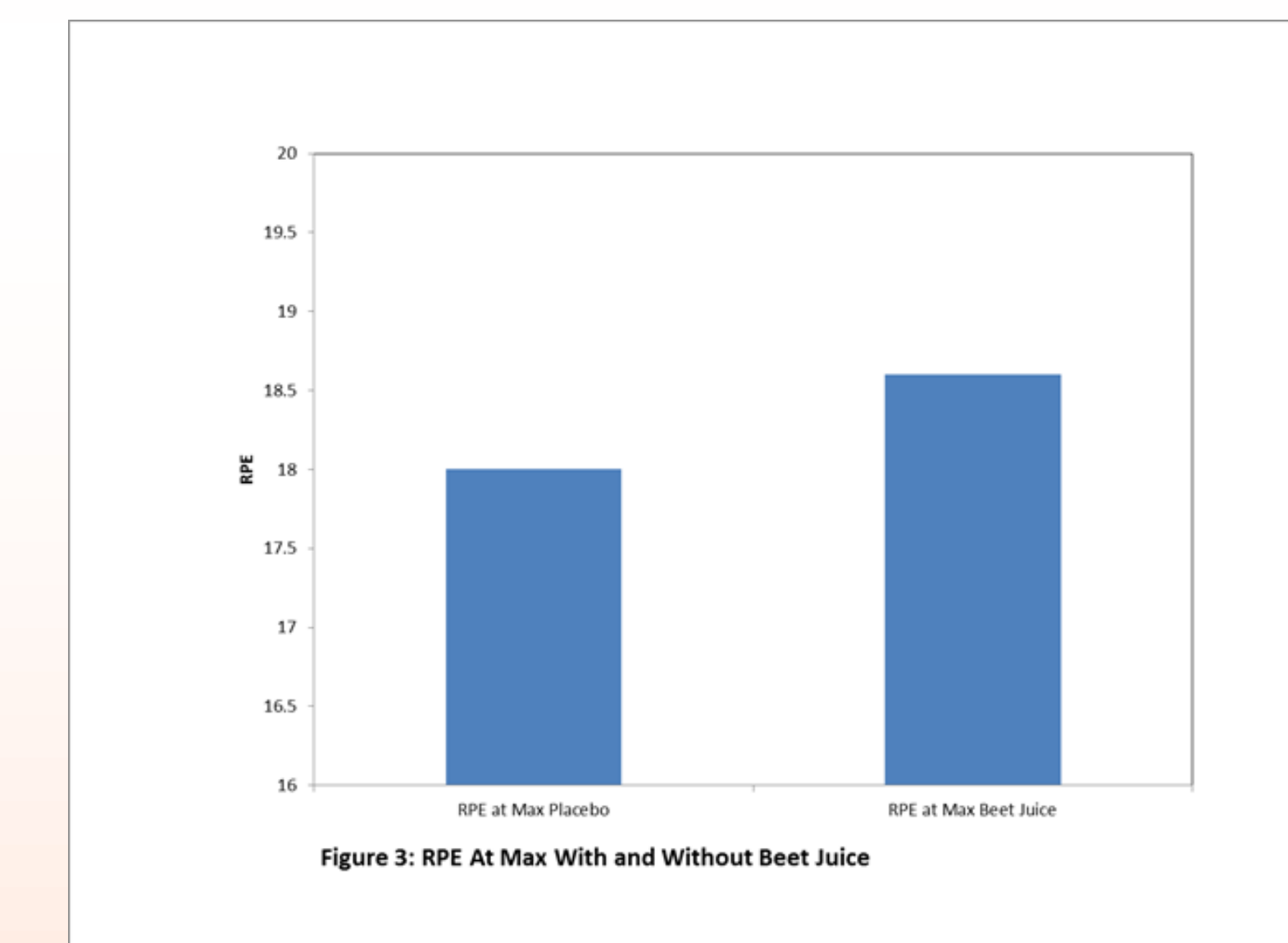
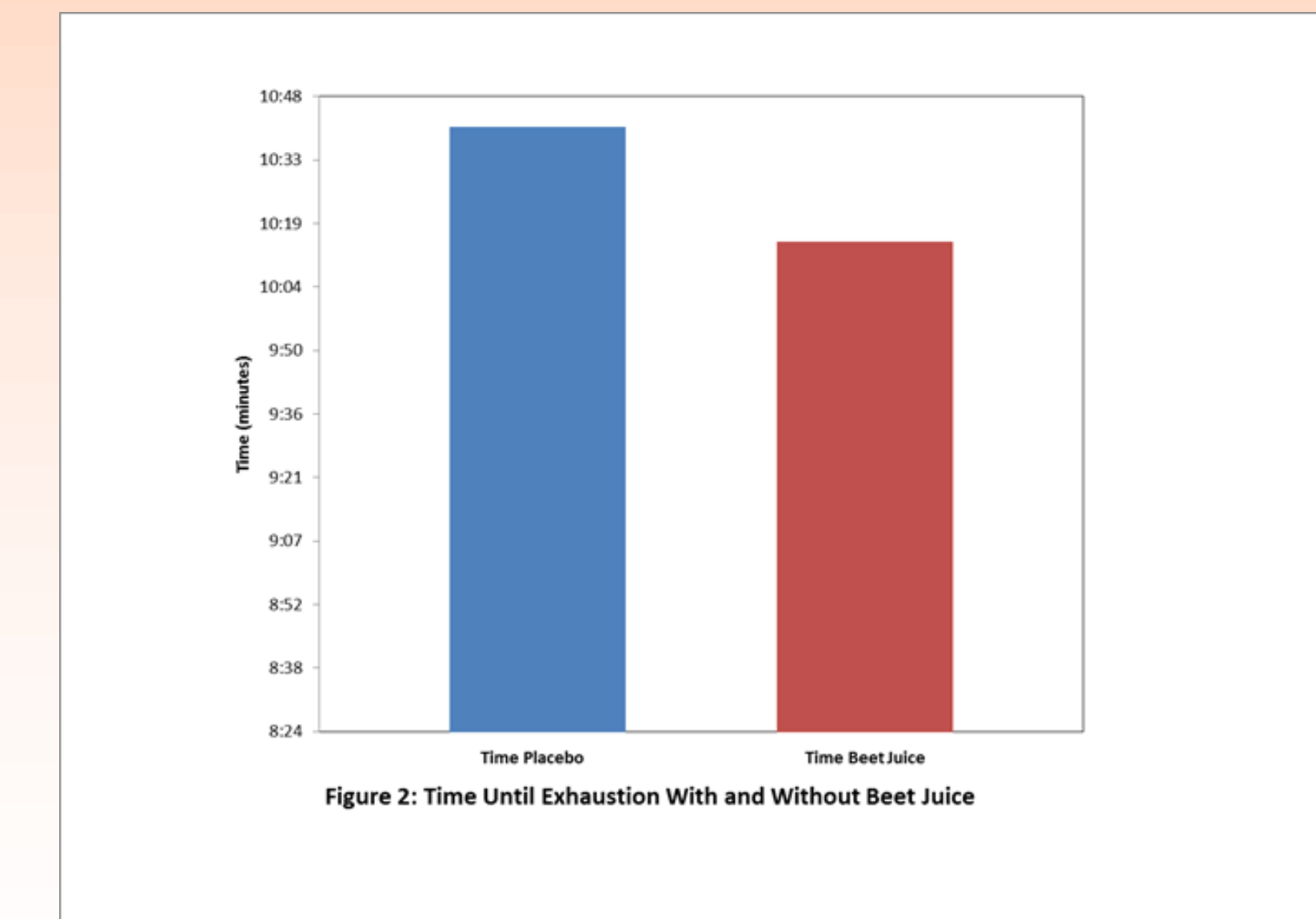
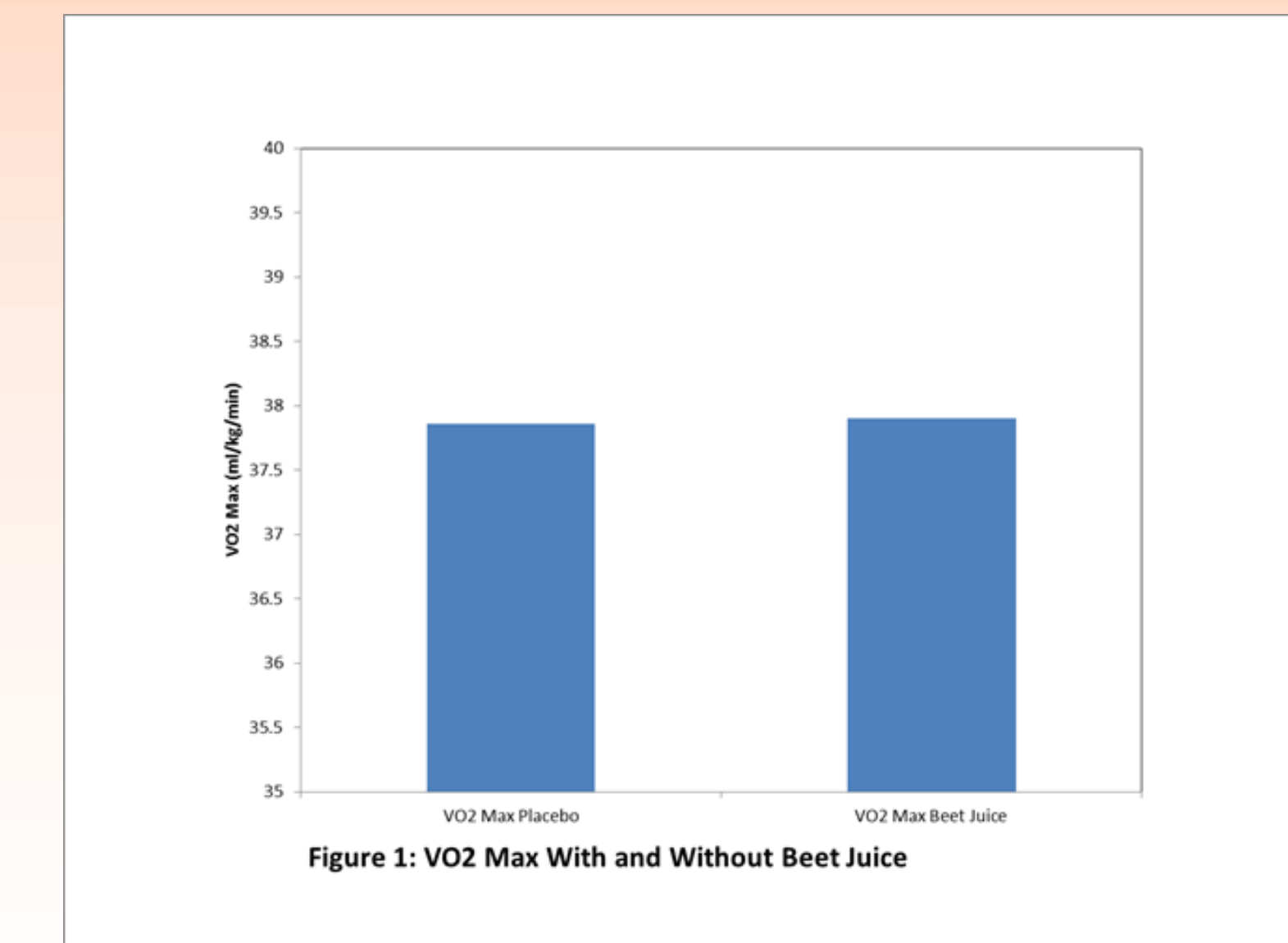
Table 1.

	Mean	SD	Max	Min
Height (m)	1.66	± 0.12	1.80	1.52
Weight (kg)	63.96	± 19.03	95.25	46.72
Body Mass Index	22.68	± 3.88	29.3	19.5
Age (yrs)	21	±1	22	20

## Results

- ❑ As seen in Figure 1, there was no significant difference (p > 0.05) in VO<sub>2</sub>max between the placebo and beet juice group.
- ❑ As seen in Figure 2, there was no significant difference (p > 0.05) in time until exhaustion between the placebo and beet juice group.
- ❑ As seen in Figure 3, there was no significant difference (p > 0.05) in RPE between the placebo and beet juice group.
- ❑ As seen in Figure 4, there was a significant difference (p=0.035) in maximal heart rate between the placebo and beet juice group.
- ❑ The heart rate decreased from an average of 196.8 ± 10.08 bpm with the placebo to 193.6 ± 11.19 bpm following acute dietary nitrate supplementation.

## Results (cont'd)



## Conclusions

- ❑ The results of this indicate that following acute dietary nitrate supplementation with beet juice there is a decrease in maximal heart rate while aerobic performance is maintained.
- ❑ It has been suggested that nitrite could be acting in place of O<sub>2</sub> as the final electron acceptor in the respiratory chain, thereby reducing the requirement for O<sub>2</sub> consumption.
- ❑ This results in an increase in mechanical efficiency.
- ❑ The decreased heart rate that was found in the present study could be a result of this increased mechanical efficiency.